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Description

LIGHT EMITTING DIODE HAVING AN ADHESIVE LAYER AND A MANUFACTURING METHOD THEREOF

BACKGROUND OF INVENTION

[0001] 1. Field of the Invention

[0002] The present invention relates to a light emitting diode, and more particularly, a light emitting diode having an adhesive layer to strengthen the structure of the light emitting diode.

[0003] 2. Description of the Prior Art

[0004] Light emitting diodes are widely used in optical displays, laser diodes, traffic lights, data storage devices, communications devices, illumination equipments, and medical equipments. Therefore, enhancing the performance of the light emitting diodes is an important issue in the field of LEDs.

[0005] Related art teaches a light emitting diode and its manu-

facturing method in which the light emitting diode is formed by adhering a transparent insulating adhesive layer to an emitting stack and a transparent substrate. The adherence is achieved by Van der Waals forces. However the Van der Waals forces are too weak to hold the emitting stack and the transparent substrate in place. Therefore the emitting stack may come off the transparent substrate easily.

SUMMARY OF INVENTION

[0006] It is therefore an object of the claimed invention to develop a light emitting diode with a strong structure to solve the aforementioned problem.

[0007] According to the first claimed invention, the method for forming a light emitting diode comprises forming a first stack, forming a second stack, forming a second reaction layer over said first stack, forming a first reaction layer over said second stack, and holding together said first reaction layer and said second reaction layer by means of a transparent adhesive layer.

[0008] According to the second claimed invention, the light emitting diode comprises a first stack, a second reaction layer formed on the first stack, a second stack, a first reaction layer formed on the second stack, a transparent adhesive

layer formed between the first and second reaction layers, and first and second electrodes formed on the first stack.

[0009] These and other objects of the claimed invention will no doubt become obvious to those of ordinary skill in the art after reading the following detailed description of the preferred embodiment that is illustrated in the various figures and drawings.

Brief Description of Drawings

[0010] FIG. 1 is a perspective view of a light emitting diode according to the present invention.

[0011] FIG. 2 is a perspective view of a first stack according to the present invention.

[0012] FIG. 3 is a perspective view of a second stack according to the present invention.

[0013] FIG. 4 is a perspective view of a third stack according to the present invention.

[0014] FIG. 5 is a perspective view of a fourth stack according to the present invention.

Detailed Description

[0015] Please refer to FIG. 1. FIG. 1 is a perspective view of a light emitting diode 1 according to the present invention. The light emitting diode 1 comprises a second substrate 10, a

first reaction layer 11 formed on the second substrate 10, a transparent adhesive layer 12 formed on the first reaction layer 11, a second reaction layer 22 formed on the transparent adhesive layer 12, and a transparent conductive layer 21 formed on the second reaction layer 22. The transparent conductive layer 21 has a first surface area and a second surface area. The light emitting diode 1 further comprises a first contact layer 13 formed on the first surface area of the transparent conductive layer 21, a first cladding layer 14 formed on the first contact layer 13, an emitting layer 15 formed on the first cladding layer 14, a second cladding layer 16 formed on the emitting layer 15, a second contact layer 17 formed on the second cladding layer 16, a first electrode 19 formed on the second contact layer 17 and a second electrode 20 formed on the second surface area of the transparent conductive layer 21.

[0016] Please refer to FIG. 2. FIG. 2 is a perspective view of a first stack 2 and the second reaction layer 22 according to the present invention. The first stack 2 and the second reaction layer 22 are formed in the following sequence: forming a first substrate 18, forming the second contact layer 17 on the first substrate 18, forming the second cladding

layer 16 on the second contact layer 17, forming the emitting layer 15 on the second cladding layer 16, forming the first cladding layer 14 on the emitting layer 15, forming the first contact layer 13 on the first cladding layer 14, forming the transparent conductive layer 21 on the first contact layer 13, and forming the second reaction layer 22 on the transparent conductive layer 21.

[0017] Please refer to FIGS. 3 to 5. FIG. 3 is a perspective view of a second stack 3 and the first reaction layer 11 according to the present invention. FIG. 4 is a perspective view of a third stack 4 according to the present invention. FIG. 5 is a perspective view of a fourth stack 5 according to the present invention. The second stack 3 and the first reaction layer 11 are formed by forming the second substrate 10, and forming the first reaction layer 11 on the second substrate 10. The third stack 4 is formed by performing a chemical reaction to generate a hydrogen bond or an ionic bond between the second reaction layer 22 of the first stack 2 and the transparent adhesive layer 12, and to generate a hydrogen bond or an ionic bond between the first reaction layer 11 of the second stack 3 and the transparent adhesive layer 12. The chemical reaction is performed with an increased temperature and may addition-

ally with an increased pressure. The fourth stack 5 is formed by removing the first substrate 18. After the fourth stack 5 is formed, the fourth stack 5 is etched to the second surface area of the transparent conductive layer 21. Then the first electrode 19 is formed on the second contact layer 17, and the second electrode 20 is formed on the second surface area of the transparent conductive layer 21 to form the light emitting diode 1.

[0018] The first substrate 18 comprises at least one material selected from a group consisting of GaP, GaAs, Ge, and the like materials. The second substrate 10 comprises at least one material selected from a group consisting of SiC, Al203, glass materials, quartz, GaP, GaAsP, AlGaAs, and the like materials. The transparent adhesive layer 12 comprises at least one material selected from a group consisting of PI, BCB, PFCB, and the like materials. The first reaction layer 11 and the second reaction layer 22 each comprise at least one material selected from a group consisting of SiNx, Ti, Cr, and the like materials. The first contact layer 13 and the second contact layer 17 each comprise at least one material selected from a group consisting of GaP, GaAs, GaAsP, InGaP, AlGaInP, AlGaAs, and the like materials. The first cladding layer 14, the emitting layer

15, and the second cladding layer 16 each comprise AlGaInP or the like materials. The transparent conductive layer 21 comprises at least one material selected from a group consisting of indium tin oxide, cadmium tin oxide, antimony tin oxide, zincoxide, zinc tin oxide, BeAu, GeAu, Ni/Au, and the like materials.

[0019] Compared with related art, a chemical reaction is performed to generate a hydrogen bond or an ionic bond between the second reaction layer 22 and the transparent adhesive layer 12, and to generate a hydrogen bond or an ionic bond between the first reaction layer 11 and the transparent adhesive layer 12. The hydrogen bonds or ionic bonds can firmly hold the second reaction layer 22 above the first reaction layer 11. Therefore the second reaction layer 22 will not come off the first reaction layer 11. The light emitting diode 1 has a strong structure.

[0020] Those skilled in the art will readily observe that numerous modifications and alterations of the light emitting diode may be made while retaining the teachings of the invention. Accordingly, the above disclosure should be construed as limited only by the metes and bounds of the appended claims.